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ABSTRACT

Three classes of junior high and first year high school students were used in laboratory sessions with Earth Science Curriculum Project, Introductory Physical Science, and Biological Science Curriculum Study materials as a model for the pre-student teaching phase of teacher training. The Small Group Interaction System was utilized in analysis of the behavior which commonly occurred in the laboratory. Student teachers attempted to produce laboratory situations using the model provided. The Verbal Interaction Category System (VICS) was utilized in analysis of student teacher presentations to the classes before and after presentation of the model. Results showed that science student teachers, when exposed to models of laboratory situations, were able, through feedback which consisted of an analysis of these laboratory situations by the Small Group Interaction System, to not only duplicate the model but to improve upon it significantly at the .05 level. The analysis of the amount of teacher behavior in each of the 21 VICS areas before and after feedback and analysis showed an improvement which was significant at the .05 level in the areas D, E, G, J, M, Q, and T. (Author)

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Final Report

Grant No. 508

THE STUDY OF STUDENT BEHAVIOR IN SCIENCE AS A RESULT OF MODIFICATION OF CERTAIN IDENTIFIABLE TEACHER BEHAVIORS

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Summary

Procedure

Three classes of junior high and first year high school students were used in laboratory sessions with E.S.C.P., I.P.S., and B.S.C.S. materials as a model for the pre-student teaching phase of teacher training.

The small group interaction system was utilized in analysis of the behavior which commonly occurred in the laboratory.

Student teachers attempted to produce laboratory situations using the model provided.

The V.I.C.S. Verbal Interaction Category System was utilized in analysis of student teacher presentations to the classes before and after presentation of the model.

Conclusions

Science student teachers when exposed to laboratory situations as a model were able through feedback which consisted of an analysis of these laboratory situations by the small group interaction system to not only duplicate the model but to improve upon it significantly at the .05 level.

The analysis of the amount of teacher behavior in each of the 21 V.I.C.S. areas before and after small group interaction feedback and analysis shows an improvement which was significant at the .05 level in areas D, E, G, J, M, Q and T.

Therefore the small group interaction system was an effective means of feedback when viewing taped laboratory situations.

SECTION I

THE PROBLEM AND PROCEDURE

Introduction

The purpose of this report is to test and modify a system for recording verbal interaction in the science laboratory. The experiment described in this report is to determine if utilizing a system of measuring group interaction in the science laboratory will increase teacher performance of teaching competence in the micro-teaching phase of teacher training.

Problem

The instructional system designed to produce teaching behavior as developed provides for (1) observation of the teacher's own performance; and (2) establishes a common model for evaluation of activites common to a science laboratory period.

The system includes television recordings of laboratory sequences which are viewed at a later time and a permanent record of group interaction.

Related Research

This research was conducted during the junior year education program prior to student teaching. A variety of models exist for the pre-student teaching experience. Some Universities utilize county schools, some local schools, and others a laboratory school. This experiment was undertaken in the laboratory school at the Wisconsin State University, La Crosse Campus. All student teaching stations or internship programs utilize the public schools.

The National Science Teachers Association produced a publication entitled, "Guidelines For Content of Pre-Service Professional Education For Secondary School Science Teachers" which develops a rationale for the professional education sequence of experiences provided for the pre-service education of science teachers. This publication was the basis of two symposia of public school science teachers of schools where student teachers are placed from this University and science education personnel from the University. This experiment here reported is one attempt to designate competencies that can and should be developed prior to student teaching. Working with students in a laboratory situation is only one aspect of the junior year of pre-service teaching experience. The experiment covers only some of the dimension in the professional pre-service preparation of science teachers. The experiment did not intend to produce a model to replace student teaching but did intend to test procedures for developing a permanent record which can be utilized to modify teacher behavior.

Efforts are under way to describe the total junior year program. The elements included in this experimental program are:

1. Planning
2. Analysis of Instruction
3. Professional Materials Study
4. Observations and Laboratory Teaching.

The fourth phase is composed of the following experiences which should be repeated until a satisfactory competence level is achieved.

1. Have practice in developing in students a skill.
2. Serve as a committee guide.
3. Have experience securing a range of reading materials.
4. Prepare listening tapes for individual or autotutorial systems.
5. Analyze achievement tests.
6. Prepare for a parent conference.
7. Have a variety of experiences in the presentation of ideas.
8. Have an experience of organizing and expressing ideas.
9. Gain experience in fitting ideas to situations or illustrating a concept several ways.
10. Have experience providing for individual differences by drawing examples from areas of specialization.
11. Become aware of classroom conditions and student individual needs.
12. Experience organizational procedures.
13. Be measured as to attitude toward teaching.
14. Gain experience in use of classroom materials.
15. Have experiences in encouraged extra class activities.
16. Have the experiences of developing a desired measurable student behavior.
17. Explore ways to encourage critical thinking.

For this experiment, episodes will emphasize experiences 7,8,9, 10 and 11 of the above list.

A variety of systems designed to analyze pupil teacher interaction have been developed. The best known of these systems is Flanders Interaction Analysis. Further experiments and research has led to the design of a model for student behaviors in a typical laboratory period. Gary M. Ferrence and Hans O. Anderson reported in Readings in Science Education for the Secondary School, Anderson, Hans O., The Macmillan Company, 1969, the development of a model of twelve categories totally inclusive and mutually exclusive which, appear to describe accurately the activities which occur in a laboratory situation. This model is used in this experiment as a cuing device.

Changed teacher behavior can best be accomplished by including a cue discrimination in the feedback of a teaching sequence as shown by experiments

at Stanford and at La Crosse. Experiments in feedback are reported in, Training Effects of Feedback and Modeling Procedures on Teaching Performance, (McDonald and Allen, 1967); and The Study of Student Achievement As a Result of Modification of Certain Identifiable Teacher Behaviors, (Widell, Merwin, and Neman, 1969).

Video taping occured in the science laboratory of the Campus Laboratory School where are located camera, microphone, and monitor. Through cable and phone connection the sequences were taped in the audio visual center by Ampex 1" tape. Taped sequences could be called up and observed at a later time in a viewing carrel located in the materials center.

To attempt to omit differential cuing of laboratory sequences the small group interaction model was utilized. The twelve categories of the model are as follows and are defined in Appendix A.:

1. Questioning terminology
2. Questioning procedures
3. Questioning observations
4. Verbal responses to observations
5. Explanatory statements
6. Hypothesizing
7. Assigning tasks
8. Unclarified pertinent discussion
9. Irrelevant discussion
10. Silence
11. Indirect teacher influence
12. Direct teacher influence

A behavior is recorded every three seconds and tallies are displayed on a 12 by 12 matrix.

SECTION II

THE EXPERIMENT

The laboratory sequences recorded were with ESCP, Earth Science Curriculum Project; I.P.S., Introductory Physical Science; and B.S.C.S., Biological Science Curriculum Study materials.

The small group interaction model was analyzed as to changes in the distribution of tallies at the beginning of the experiment as compared to the end of the micro-teaching period.

Three classes of 24 students, one in each of the above areas of study were utilized. Microlessons or periods of laboratory supervision were designed from the Campus Laboratory Instructors Lesson Plan.

All laboratory interactions were recorded by an audio tape recorder which was later analyzed.

The college instructor managed the recording process, served as rater for the small group interaction and cued student teachers while together viewing video tape sequences.

An assistant trained in V.I.C.S., Verbal Interaction Category System recorded all microlessons.

SECTION III

FINDINGS

SMALL GROUP INTERACTION

A semester course of general principles and practices completed prior to studen teaching is composed of three general areas of work: exposition, micro-teaching, an observation. For this experiment, a two cycle micro-teaching period followed five weeks of exposition. A total of 22 laboratory situations and 12 discussion sessions were analyzed for this experiment. The laboratory periods were regular periods of laboratory work in E.S.C.P., I.P.S., and B.S.C.S. programs. The discussion sessions were of 10-15 minute duration each. Each laboratory situations was recorded on audi tape and later analyzed with the aid of the small group interaction model. The student teacher directed laboratories were also video-taped for later viewing by the student teacher while being cued by the college instructor. Each discussion sessio was recorded by the Verbal Interaction Category System. This system was not utilized in the cuing of students, but was used to test whether cuing by small group interaction model had an effect on teacher behavior change.

In the first cycle of this experiment each student teacher was exposed to a laboratory situation as an observer noting the variety of activities which occured during the period. The second cycle was composed of student teacher direction of laboratory situations.

Each of the 22 laboratory situations were recorded via the small groups interaction model. Every three seconds a category was recorded which appeared to best describe the type of activity exhibited during that period of time. The categories can be grouped for analysis.

The first nine categories involve student exhibited activities. Of all these activities it would appear that verbal responses to observations and hypothesizing would be most productive and would exhibit that kind of behavior which is most descriptive of those behaviors most desired by teachers. This behavior can be compare to all student behavior which can be displayed as follows:

$$\text{Index of process} \quad P = \frac{\Sigma\, 4, 6}{\Sigma\, 1, 2, 3, 4, 5, 6, 7, 8, 9}$$

The next most desirable type of student behavior is composed of explanatory statements and unclassified pertinent discussion. These behaviors can be compared as to frequency of occurrence with all student behaviors as follows:

$$\text{Index of interaction} \quad I = \frac{\Sigma\, 5, 8}{\Sigma\, 1, 2, 3, 4, 5, 6, 7, 8, 9}$$

The least desirable type of student behavior is composed of questioning termin ogy, questioning procedure, assigning tasks, and irrelevant discussion. While assi ing tasks can generally be thought of as a cooperative effort of group action a great deal of this behavior can result in members of a group experiencing only part

of the laboratory experience. These behaviors can be compared as to frequency of occurrence with other student exhibited behavior as follows:

$$\text{Experiment retardation ratio} \quad R = \frac{\Sigma\ 1,2,7,9}{\Sigma\ 3,4,5,6,8}$$

Two behaviors are determined in this experiment to be located at opposite ends of the behavior spectrum. These behaviors are hypothesizing which denotes understanding and questioning procedure which indicates a complete lack of readiness for the experience. These two behaviors can be compared in frequency as follows:

$$X = \frac{6}{2}$$

In this experiment when the student laboratory behavior exhibited resulted in a high index of P and of I a minimum of teacher direction was necessary. The laboratory duties of the instructor becomes one of facilitating through providing only required equipment and materials.

If the ratio R becomes high, teacher-student interaction should be initiated in order to increase P and I for if R increases P and I will decrease. Indirect teacher influence is preferred to direct influence. A measure of the amount of teacher direction and student confusion can be computed as follows:

$$\text{Index of teacher interaction} \quad Y = \frac{\Sigma\ 1,2,11,12}{\Sigma\ 1,2,3,4,5,6,7,8,9,\ 10,11,12}$$

The process of laboratory direction is then, in the last analysis, the measured amount of teacher interaction necessary to maintain a productive laboratory situation.

The summations of the laboratory activity groupings are included in Table 1. Laboratory situation number 9 provides what might be considered the best situation because of the great amount of student interaction and the small amount of teacher direction and irrelevent discussion. If one could be identified as the least desirable situation it possibly would be number 3 because of the larger amount of student interaction not yielding results. As a model however it was quite acceptable.

LAB	6/2	5,8/1-9	4,6/1-9	1,2,11,12/1-12	1,2,7,9/3,4,5,6,8
1.	0	.30	.34	.27	.38
2.	.26	.34	.27	.15	.35
3.	.08	.55	.14	.19	.44
4.	.05	.37	.31	.10	.40
5.	.66	.61	.09	.06	.41
6.	.10	.54	.27	.05	.11
7.	.12	.63	.19	.27	.21
8.	.75	.49	.32	.28	.17
9.	.88	.41	.43	.21	.04
10.	0	.57	.24	.11	.21
11.	0	.54	.32	.08	.10
Average	.26	.48	.26	.16	.25

TABLE I

Summary of Model Laboratory Situation

LAB	6/2	5,8/1-9	4,6/1-9	1,2,11,12/1-12	1,2,7,9/3,4,5,6,8
1.	0	.41	.30	.16	.37
2.	0	.63	.24	.04	.13
3.	*	.37	.42	.19	.16
4.	1.0	.28	.64	.14	.005
5.	.27	.66	.17	.20	.17
6.	1.0	.67	.26	.05	.07
7.	0	.57	.30	.08	.10
8.	*	.60	.28	.09	.09
9.	0	.56	.28	.04	.12
10.	1	.59	.35	.07	.05
11.	0	.71	.17	.08	.12
Average	.29	.55	.31	.10	.125

TABLE II

Summary of Laboratory Situation
Supervised by Student Teacher

* no tallies were recorded in these categories.

Table II includes the summations of student teacher directed laboratory situations. The student directed laboratory sessions were compared to the model by using the χ^2 statistic.

	O	E	O	E	O	E	O	E	O	E	Total
Table I	26	(27.8)	48	(52.1)	26	(28.8)	16	(12.7)	25	(19)	141
Table II	29	(27.2)	55	(50.8)	31	(28.5)	10	(12.8)	12.5	(18.5)	137.5
totals	55		103		57		26		37.5		278.5

The theoretical frequency was computed for each category and the χ^2 computed as 6.7.

For 4 degrees of freedom $\chi^2_{.95} = 2.21$.

The student directed laboratory sessions were significantly better than the model presented.

Verbal Interaction Category System (VICS)

Amidon and Hunter report the development of the Verbal Interaction category System in Readings in Science Education for the Secondary School. The 21 categories and their explanation are located in appendix B of this report. The matrix for VICS was also duplicated and placed in appendix C of this report.

The purpose of this research was to evaluate changes in teacher behavior of science student teachers doing micro-teaching in a science laboratory. The model presented by Amidon and Hunter was used. Two general assumptions were made after a careful study of the VICS matrix. The general assumptions were: (1) that classroom interaction is more desirable in certain categories; (2) that classroom interaction is less desirable in certain categories.

In accordance with those assumptions categories C, E, G, K, L, N, O, P, Q, S, and T were judged to be desirable and categories A, B, D, F, H, I, J, M, R, and U were judged to be less desirable.

Parallel research hypotheses were formulated.

H_1: Following feedback the average percent for the six science student teachers in categories C, E, G, K, L, N, O, P, Q, S, and T would increase.

H_2: Following feedback the average percent for the six science student teachers in categories A,B,D,F,H,I,J,M,R, and U would decrease.

The corresponding null hypotheses were:

Null H_1: Following feedback the average percent for the six science student teachers in categories C,E,G,K,L,N, O,P,Q,S, and T would decrease or remain the same.

Null H_2: Following feedback the average percent for the six science student teachers in categories A,B,D,F,H,I, J,M,R, and U would increase or remain the same.

The procedure for testing the two null hypotheses followed this pattern.

(1) Six science student teachers taught a micro-lesson in a science laboratory situation. The teacher behavior patterns were recorded by a trained observer. Percents were computed for each student teacher in each VICS category. See Table III.

(2) Feedback was accomplished through the use of the small group interaction model as previously reviewed.

Table III

PERCENT OF TEACHER BEHAVIOR RECORDED IN MATRIX AREAS

BY SIX SCIENCE STUDENT TEACHERS DURING PHASE I

Matrix Area	Student Teachers						Average Percent
	1	2	3	4	5	6	
	Percent						
A	52	52	18	29	15	75	40
B	3	1	1	1	1	1	1
C	14	12	8	10	20	5	12
D	6	5	6	10	6	4	6
E	0	0	1	0	0	1	0
F	0	0	0	0	0	0	0
G	0	1	5	1	2	1	2
H	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
J	1	1	1	2	0	0	1
K	7	5	3	3	12	1	5
L	4	4	6	9	7	3	6
M	1	2	1	2	1	0	1
N	1	2	18	19	13	0	9
O	0	0	0	0	0	0	0
P	2	1	1	0	3	2	2
Q	1	1	0	0	0	0	0
R	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	4	1	1	0	4	0	2
U	7	13	31	16	24	13	17

Table IV

PERCENT OF TEACHER BEHAVIOR RECORDED IN MATRIX AREAS
BY SIX SCIENCE STUDENT TEACHERS DURING PHASE II

Matrix Area	Student Teachers						Average Percent
	1	2	3	4	5	6	
	Percent						
A	64	79	23	61	22	25	46
B	2	0	1	0	4	0	1
C	4	5	12	6	8	10	8
D	3	0	3	1	5	4	3
E	0	0	2	0	2	0	1
F	0	0	0	0	0	0	0
G	3	2	5	0	7	0	3
H	0	0	0	0	0	0	0
I	0	0	0	0	0	2	0
J	0	0	1	0	0	0	0
K	4	2	7	1	4	5	4
L	3	2	5	1	5	3	3
M	0	0	0	0	0	0	0
N	3	5	8	1	15	3	6
O	0	0	2	1	0	0	0
P	1	2	3	3	2	0	2
Q	0	0	2	0	2	0	1
R	0	0	0	0	0	0	0
S	0	0	1	0	0	0	0
T	3	2	3	6	25	0	7
U	12	0	26	15	2	50	17.5

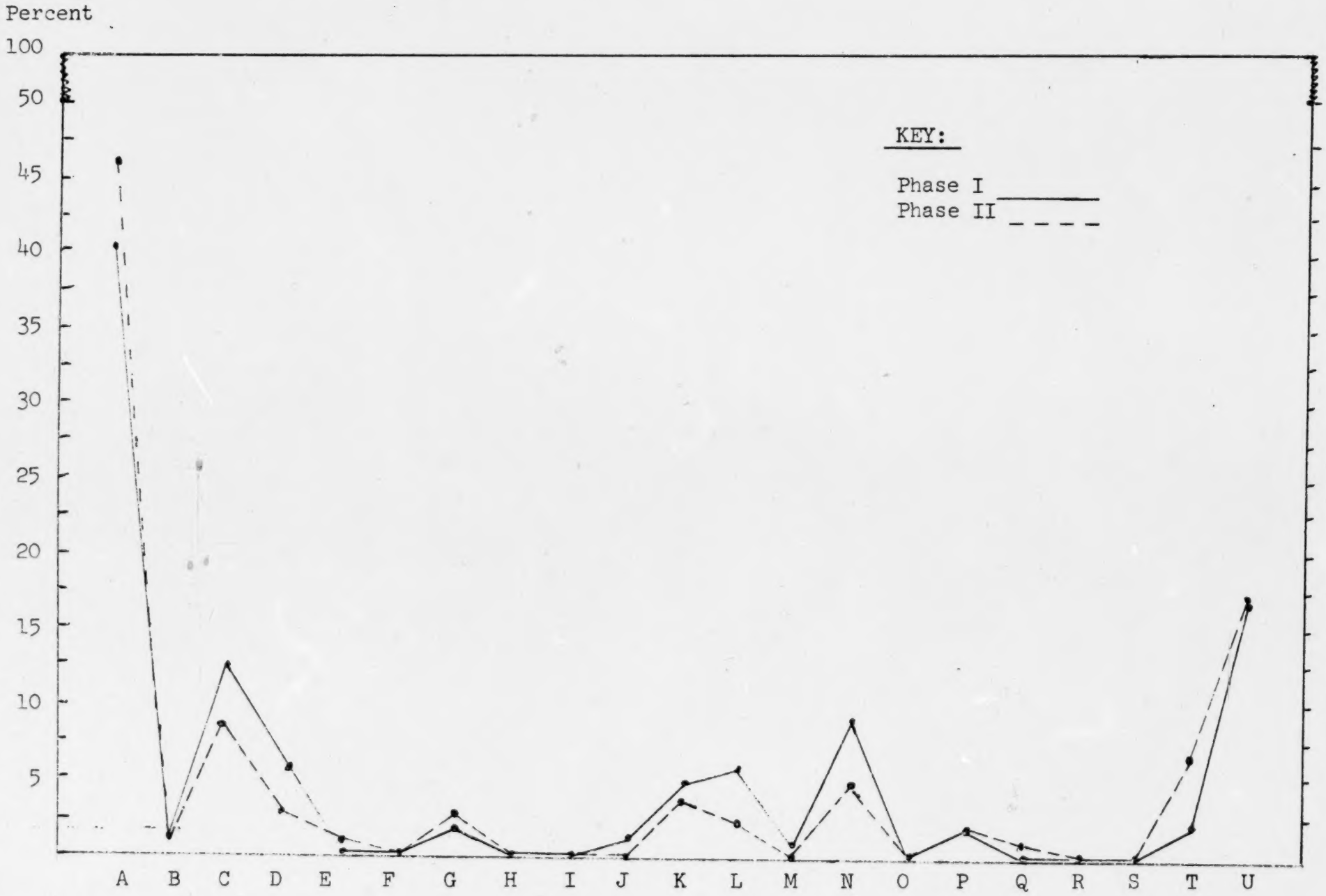

Figure I

THE AVERAGE PERCENT TALLIED IN EACH MATRIX AREA (VICS) DURING PHASE I AND PHASE II

(3) The same six science student teachers taught a second micro-lesson as part of a science laboratory situation. The teacher behavior patterns were recorded by a trained observer. Percents were computed for each student teacher in each VICS category. See Table IV. The average percents for the six science student teachers were plotted in figure I.

(4) Tables III and IV were analyzed to determine if teacher behavior was modified by feedback from the small group interaction model.

(5) Values for t were computed for each of the VICS categories. A one-tailed t test $t = \frac{\bar{d}}{S/\sqrt{N}}$ reported in Introduction to Statistical Analysis Second Edition by W.J. Dixson and F.J. Massey was used for computing t values. A one-tailed t test was used since only significant changes in the hypothesized direction were tested. Categories in which significant changes in teacher behavior occured were reported in Tables V and VI.

Table V

SIGNIFICANT t VALUES FOR MATRIX AREAS
HYPOTHESIZED TO INCREASE

Degrees of Freedom	Matrix Area	Value of t
N-1 = 5	E	+5.22***
N-1 = 5	G	+7.84***
N-1 = 5	Q	+3.92**
N-1 = 5	T	+2.98*

*** Significant at the .005 level.
** Significant at the .01 level.
* Significant at the .05 level.

Table VI

SIGNIFICANT t VALUES FOR MATRIX AREAS
HYPOTHESIZED TO DECREASE

Degrees of Fredom	Matrix Area	Value of t
N-1 = 5	D	-17.5*
N-1 = 5	J	-13.1*
N-1 = 5	M	-19.3*

*Significant at the.005 level.

SECTION IV

CONCLUSIONS

Conclusions

Science student teachers when exposed to laboratory situations as a model were able through feedback which consisted of an analysis of these laboratory situations by the small group interaction system to not only duplicate the model but to improve upon it significantly at the .05 level.

The analysis of the amount of teacher behavior in each of the 21 V.I.C.S. areas before and after small group interaction feedback and analysis shows an improvement which was significant at the .05 level in areas D, E, G, J, M, Q and T.

Therefore the small group interaction system was an effective means of feedback when viewing taped laboratory situations.

Flanders and Amidon have been consistent in their appeal that their system of recording teacher behavior and the resulting matrix not be used to identify good or bad teaching examples. The present experimentors are not necessarily promoting this idea; however, it was believed that in fact judgments of this nature are made at the conference with the supervisor and teacher.

In this research judgments were made indicating that teacher behavior in certain areas was desirable and that teacher behavior in certain other areas was less desirable. Feedback was geared to this idea. Further research in the area of identifying desirable teacher behavior and strategies as shown by the matricies is needed.

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APPENDIX A

SMALL GROUP INTERACTION CATEGORIES

Twelve Categories for Small Group Interaction

1. Questioning terminology. Questions or statements voiced for the primary purpose of soliciting a response. Questions should deal primarily with the definition of terms or listing of basic characteristics.

2. Questioning procedures. Questions or statements voiced for the primary purpose of acquiring information about the procedures to be followed, functioning of apparatus, or setting up of equipment.

3. Questioning observations. Questions or statements for which answers are sought or expected and which follow observations made during the period.

4. Verbal responses to observations. Comments generated in reaction to observations made throughout the period (this would include questions for which no answers are expected).

5. Explanatory statements. Statements made with the intention of clarifying others' ideas, answering others' questions asked in the laboratory guide.

6. Hypothesizing. Suggestions or inferences which express expected results.

7. Assigning tasks. Verbal communication expressed with the intent of directing someone to action.

8. Unclassified pertinent discussion. General statements or comments which are relevant to the material being studied.

9. Irrelevant discussion. Comments not pertinent to the material being studied.

10. Silence. Periods of silence or confusion in which communication cannot be categorized. This category would also include time during which students are engrossed in nonverbal laboratory activity.

11.* Direct teacher influence. Teacher talk in the form of lecturing, giving directions, criticizing, or justifying authority (see Flanders).

12.* Indirect teacher influence. Teacher talk in the form of encouragement, praise, questions, or development of students' ideas (see Flanders).

* For this study these two categories are reversed.

APPENDIX B

THE V.I.C.S. CATEGORIES

The VICS Categories

Teacher Initiated Talk: Teacher Initiated Talk is divided into four categories: (1) Presents Information or Opinion, (2) Gives Direction, (3) Asks Narrow Question, (4) Asks Broad Question.

1. Presents Information or Opinion. Category 1 is used when the teacher is presenting facts or opinions to the class, either in the form of short statements or in the form of an extended lecture. Generally, this category is used when the teacher is presenting content. Explanation, discussion and rhetorical questions are included here.

2. Gives Direction. Whenever the teacher tells the students to take some specific action, category 2 is used. Examples of this category are: "Open your books to page five," "Take your seats," and "Please add the following numbers." Direction may be given in question form, as for example, "Will everyone turn around?" or "Can you come here a moment, Jane?"

3. Asks Narrow Question. If the general nature of the response can be predicted, category 3 is tallied. Drill questions and questions requiring one word or yes-or-no answers fall into this category. "How much is three and three?" "What is the capital of France?" "Is that correct?" "What happened next in the story?" "What are the principal exports of Brazil?" --are examples of narrow or predictable response questions.

4. Asks Broad Question. Questions which fall into category 4 would be relatively open-ended. When the teacher asks questions which are thought-provoking or require expressions of opinion or feeling, this category is used. The broad or unpredictable response question is more apt to elicit a rather long response, while the predictable response question is more apt to bring forth a short reply. Examples of broad questions are: "Can you tell me some things you know about the number three?" "Why do you think that Paris came to be the capital of France?" "What are some other things the author might have written in this story?" "What are some of the ways in which geography and history have probably influenced Brazilian production and exports?"

Teacher Response. Teacher Response contains two categories, each of which includes three possibilities. They are (5) Accepts (a) Ideas, (b) Behavior, (c) Feeling, and (6) Rejects (a) Ideas, (b) Behavior, (c) Feeling.

5a. Accepts Ideas. When the teacher accepts, reflects, clarifies, encourages or praises an idea of a pupil, category 5a is used. If the teacher summarizes the ideas of the pupil or of several pupils, or comments upon the ideas without rejecting them, this category is indicated. Saying "Good," "Yes," and so forth, are examples of category 5a.

5b. Accepts Behavior. Responses to pupil's behavior which are accepting and encouraging of that behavior fall into category 5b. Such statements as, "I like the way the boys and girls in this group are behaving," "Billy really knows how to use books properly," and "We can be proud of the way we handled ourselves on our trip," are all examples of 5b.

5c. Accepts Feeling. When the teacher responds to pupils' feelings in an accepting manner, or merely reflects their feelings, this category is used. "I know that it's a warm day and many of us would rather be outside," "Of course you feel disappointed because there isn't any assembly program today," "I'd be happy, too, if that happened to me," and "No wonder you feel sad," are examples of category 5c.

6a. Rejects Ideas. Category 6a is used when the teacher rejects, criticizes ignores, or discourages pupil's ideas. "No," "Can someone else tell us the right answer?" "That's not right," "Where did you ever get <u>that</u> idea!" "Is that what I asked you to discuss?" are examples of category 6a. Note that some of them are stated in question form, but would be taken by pupils as criticism.

6b. Rejects Behavior. Teacher comments that are designed to discourage or criticize pupil behavior fall into category 6b. "I said to sit down!" "We shouldn't have our books open now," "Where do you think you are?" are all expressions of rejection of behavior. The tone of voice and the resultant effect are what differentiate these from the categories of giving direction and asking questions.

6c. Rejects Feeling. When teachers respond to pupil's expression of feelings by ignoring, discouraging, or rejecting them, category 6c is noted. "Aren't you ashamed of yourself for crying?" "Just because there's no assembly today doesn't mean we need to sit and mope," "There's no need to bring our personal feelings up," are examples of this category.

Pupil Response. Pupil Response, the third major division, contains two categories: (7) Responds to Teacher and (8) Responds to Another Pupil. Category 7 is subdivided into (a) Predictably and (b) Unpredictably.

7a. Responds to Teacher Predictably. This would ordinarily follow category 3, a narrow question from the teacher, and would tend to be a relatively short reply. Category 7a also frequently follows category 2 a direction; as for example, when the teacher says, "David, read the first line on page six."

7b. Responds to Teacher Unpredictably. This category would usually follow the asking of a broad question by the teacher. However, a pupil may give an unpredictable response to a question which is tallied as a category 3, a narrow question. For instance, when a teacher asks,

"What was the cause of this conflict?" a pupil may reply, "It would seem to me that there isn't any one cause -- I think there were many factors at work."

8. Responds to Another Pupil. Whenever one pupil responds to the question or ideas of another, category 8 is used. When there is conversation between pupils, replies would be noted in this category.

Pupil Initiated Talks. Pupil Initiated Talk is the fourth major division in the VICS, and contains two categories: (9) Talks to Teacher and (10) Talks to Another Pupil.

9. Talks to Teacher. If a pupil initiates a conversation with the teacher, then category 9 is used. "Will we have art today?" "I don't understand how to do this problem," "Here's a clipping I brought in for our social studies project," "Would you repeat that last part again?" are all examples of category 9.

10. Talks to Another Pupil. Any conversation which one pupil initiates with another falls into this category.

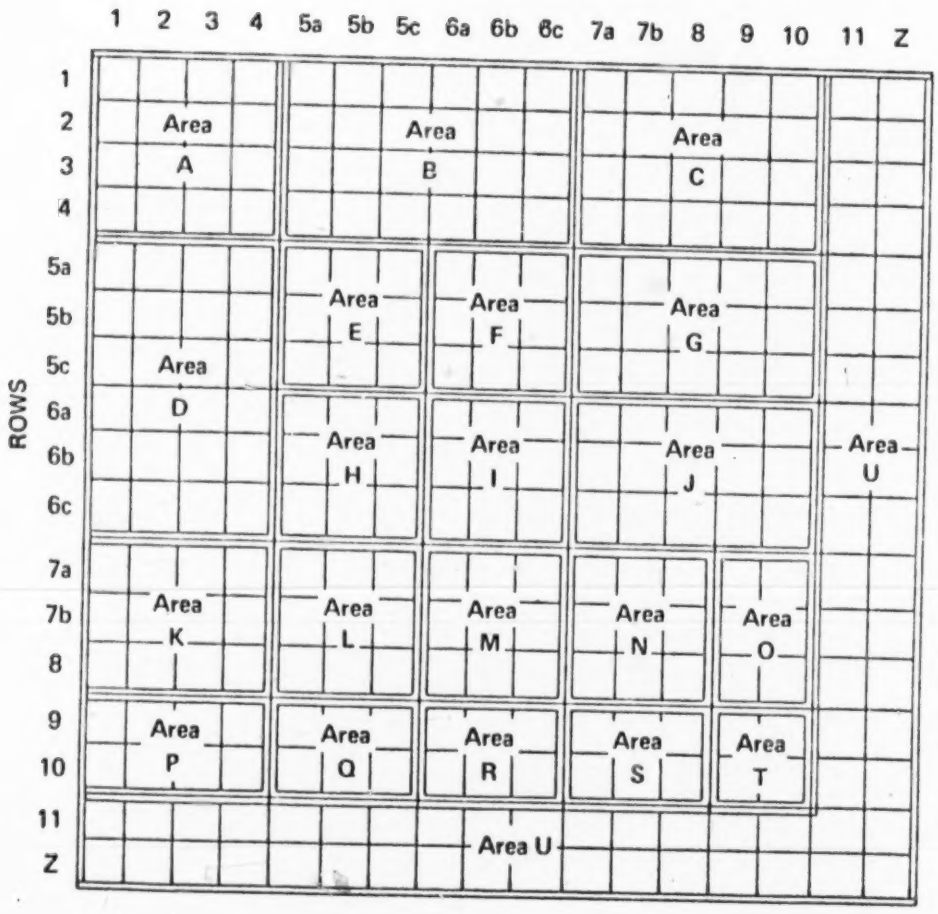
Other: This is the last major division in the system, and contains two categories, which are (11) Silence and (Z) Confusion.

11. Silence. Category 11 is tallied when there are pauses or short periods of silence. For long periods of silence, as when the class is engaged in seat work or silent reading, the observer simply notes this in the margin and stops tallying.

Z. Confusion. When there is considerable noise and disruption of planned activities, this category is used. Z may also be placed alongside another category to indicate some accompanying confusion while the teacher and some pupils continue with the scheduled activities (see Honigman reference 5).

APPENDIX C

AREAS WITHIN THE MATRIX IN THE V.I.C.S.



Reprinted from: "Readings in Science Education for the Secondary School" by Hans O. Andersen.

Areas Within the Matrix in the VICS

Area A: This is the area of prolonged teacher initiation, and includes presenting information or opinion, giving directions and asking questions. The major characteristic of this area is that the teacher is speaking for a relatively long period. This is not an area which shows interaction between pupil and teacher.

Area B: The cells in this area indicate teacher initiated statements followed by teacher response statements, either accepting or rejecting.

Area C: This group of cells includes all student talk which follows teacher initiated talk.

Area D: Area D indicates teacher response statements followed by teacher initiated statements.

Area E: This area indicates prolonged accepting behavior on the part of the teacher. This includes extended acceptance of ideas, behavior and feelings, as well as transitions from one of these verbal patterns to another.

Area F: These cells indicate teacher accepting behavior followed by teacher rejecting behavior.

Area G: This area shows accepting teacher statements followed by any student statements.

Area H: Area H indicates teacher rejecting behavior followed by teacher accepting behavior.

Area I: These cells indicate extended rejecting behavior on the part of the teacher. Rejection of ideas, behavior and feeling are indicated here, as well as transition from one of these behaviors to another.

Area J: These cells show all student statements which follow teacher rejecting statements.

Area K: This area indicates student response behavior followed by teacher initiated behavior.

Area L: This group of cells show student response followed by teacher acceptance.

Area M: Area M shows teacher rejection of student responses.

Area N: These cells show extended student response to either the teacher or another pupil.

Area O: Area O indicates student response statements followed by student initiated statements.

Area P: These cells indicate student initiated behavior followed by teacher initiated behavior.

Area Q: This area shows student initiated talk followed by teacher acceptance.

Area R: Area R indicates teacher rejection of student initiated talk.

Area S: These cells indicate student initiated statements followed by student response statements.

Area T: This area indicates extended student initiated talk to either the teacher or another pupil.

Area U: Area U indicates silence or confusion. If the tallies are in row or column 11 they indicate silence, and if they are in row or column Z, they indicate confusion. Tallies in columns 11 or Z represent silence or confusion following teacher or student talk, while tallies in rows 11 to Z represent silence or confusion after student or teacher talk.